

Phase 5: Regulatory Action Selection

Final Project Report

Total Maximum Daily Load for Dissolved Oxygen in Chumash Creek, San Luis Obispo County, California

DRAFT

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Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

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1. INTRODUCTION

Chumash Creek was included on California's section 303(d) list of impaired waters for dissolved oxygen. The Clean Water Act requires a Total Maximum Daily Load (TMDL) be developed to restore impaired waterbodies to their full beneficial uses. This report presents the dissolved oxygen TMDL for Chumash Creek. This section presents background information on the creek's 303(d) listing, describes the watershed and summarizes this report's outline and content.

1.1. Project Definition

Chumash Creek was listed as impaired for dissolved oxygen on the 2002 303(d) list. Review of available water quality monitoring data from the Morro Bay National Monitoring Program (NMP) and the Morro Bay Volunteer Monitoring Program (VMP) (1993-2004) indicate that dissolved oxygen is periodically falling below the numeric water quality objective for percent saturation at the monitoring station in Chumash Creek.

To further characterize the impairments in the creek and identify potential causes, data analyses were conducted to examine relationships between nutrient levels, algal growth, water temperature, and dissolved oxygen. Results of evaluating the effectiveness of implementing Best Management Practices (BMPs) in improving water quality (i.e. dissolved oxygen) were also reviewed.

The conclusions that can be drawn from available data include:

- The general dissolved oxygen water quality objective of 5 mg/l is being met.
- The general dissolved oxygen water quality objective of 85 percent saturation is not being met.
- Improvements in dissolved oxygen levels have been observed as a result of BMP implementation.
- Nutrient levels are typically low; nitrate levels do not exceed the water quality objective for the municipal and domestic water supply (MUN) use of 10 mg/L.
- No significant reductions in nitrates or phosphates were observed as a result of BMP implementation; the relationship to dissolved oxygen levels is indeterminate.
- Limited algae has been observed, however, insufficient algal growth information are available to determine if it is contributing to depressed dissolved oxygen levels.
- Significant improvements in water temperature have been observed as a result of BMP implementation, however the relationship to dissolved oxygen levels is indeterminate.
- Multiple factors (canopy, temperature) are likely to have contributed to the dissolved oxygen impairment
- While data coverage is insufficient to derive an explicit linkage between dissolved oxygen levels and other environmental conditions (e.g., canopy); improvements as a result of implementing BMPs are occurring.

Based on the review of available information the TMDL approach is as follows:

1. Develop a dissolved oxygen TMDL to attain current numeric water quality objectives.
2. Continue to implement existing BMPs. Improvements in dissolved oxygen levels are already occurring as a result of implementation and are expected to result in TMDL achievement.
3. Approve modifications to the California Polytechnic State University Waste Discharge Requirements and associated Water Quality Management Plan to include TMDL elements during the next permit renewal in 2008.

1.2. Watershed Description

Chumash Creek is located in San Luis Obispo County on the central coast of California. The watershed is in a Mediterranean climate, with warm dry summers and cool wet winters. The geology of the watershed is a mix of igneous, metamorphic and sedimentary rock less than 200 million years old. Average temperature is about 12°C (54°F). Average annual rainfall ranges from 45 cm (18 inches) at the coast to 89 cm (35 inches) on the Cuesta ridge; most of this rainfall occurs between November and April (sources: Department of Water Resources, 1958; Ernststrom, 1984).

Chumash Creek is a tributary to Pennington Creek which drains to Chorro Creek, and ultimately to the Morro Bay estuary (Figure 1). Land use in the Chumash Creek watershed is rangeland. California Polytechnic State University (Cal Poly), the sole landowner in the watershed, began implementing Best Management Practices (BMPs) in the Chumash Creek watershed in 1995 and 1996. BMPs fell within four categories of rangeland management practices: livestock fencing and water development, streambank stabilization, road improvement, and grazing management. Funding was provided by a Clean Water Act Section 319(h) grant. BMPs continue to be implemented.

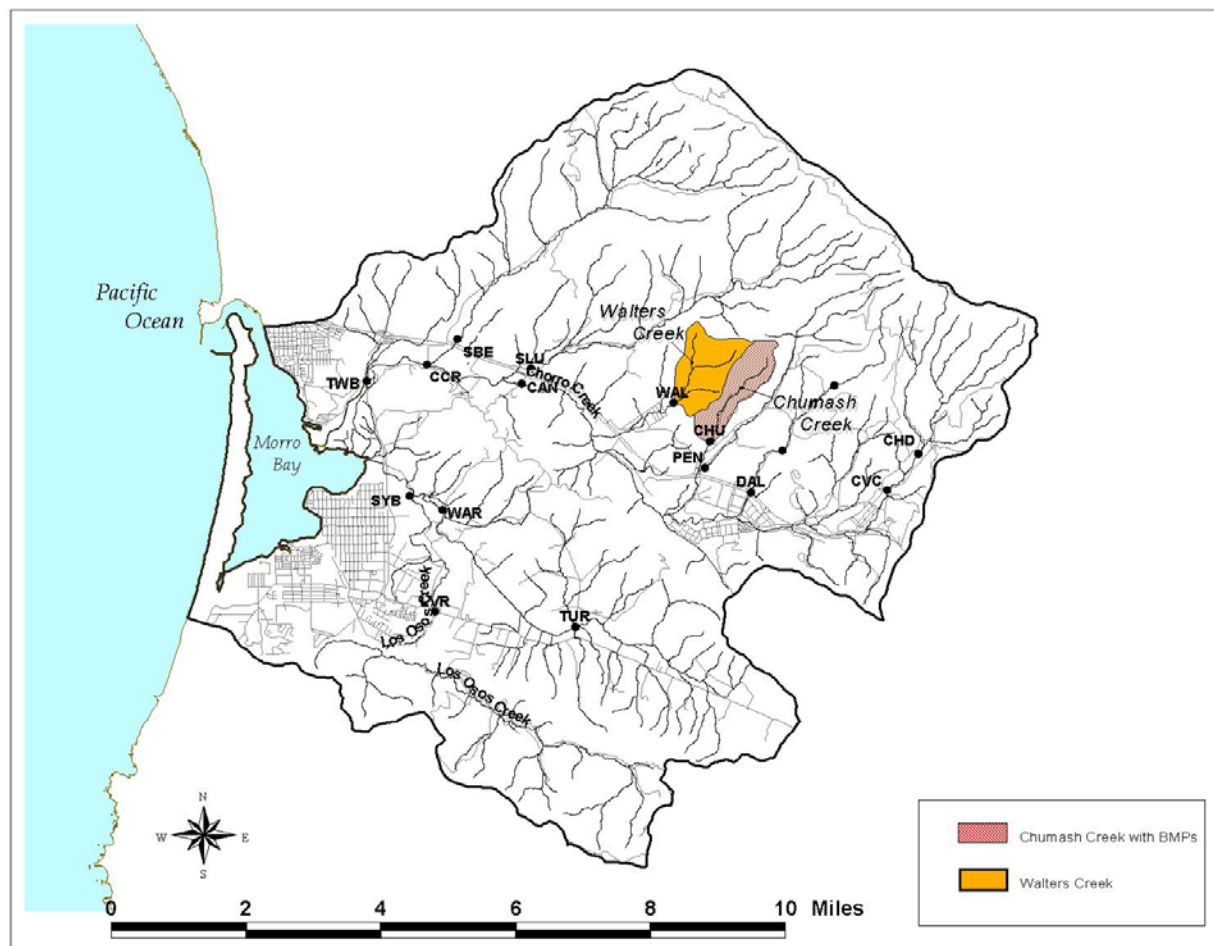


Figure 1. Watershed and monitoring site within the Chumash Creek watershed.

1.3. Structure of Document

The following sections are included in this TMDL report:

- **Project Definition:** Identifies the 303(d) listing for Chumash Creek and summarizes available information to characterize impairment.
- **Water Quality Standards:** Identifies the water quality standards applicable to the listing.
- **Data Review:** Provides an inventory and analysis of available water quality data.
- **Source Analysis:** Identifies potential sources of dissolved oxygen impairment in the watershed.
- **Dissolved Oxygen TMDL:** Identifies the dissolved oxygen TMDL for the Chumash Creek watershed, including allocations and considerations of seasonality and margin of safety.
- **Monitoring:** Discusses follow-up monitoring to track water quality improvements from the dissolved oxygen TMDL.

- **Implementation:** Discusses existing implementation activities for the dissolved oxygen TMDL, including plans for tracking the progress of implementation and the timeline for TMDL achievement.

2. WATER QUALITY STANDARDS

Regional Water Quality Control Boards (Regional Boards) define beneficial uses for waterbodies in their Water Quality Control Plans (Basin Plans). Also included in the Basin Plan are numeric and narrative objectives to be protective of the beneficial uses designated for each waterbody. The following sections discuss the applicable beneficial uses and water quality objectives related to the 303(d) listings in Chumash Creek.

2.1. Beneficial Uses

Table 1 summarizes the beneficial uses of Chumash Creek

Table 1. Beneficial uses for Chumash Creek.

Waterbody	Chumash Creek¹
Municipal and Domestic Supply (MUN).	X
Water Contact Recreation (REC-1)	X
Non-Contact Water Recreation (REC-2)	X
Warm Fresh Water Habitat (WARM)	X

¹ Chumash Creek is not specifically listed in the Basin Plan; therefore, two general uses (encompassing four Beneficial Uses) designated for all waterbodies in the Region apply to Warden Creek: Municipal and Domestic Water Supply (MUN) and protection of both recreation and aquatic life (REC-1 REC-2, WARM).

2.2. Water Quality Objectives

Water quality objectives applicable to the 303(d) listing of Chumash Creek include numeric objectives for dissolved oxygen. Numeric objectives for dissolved oxygen are listed in Table 2.

Table 2. Water quality objectives for dissolved oxygen.

Beneficial Use	Dissolved Oxygen Objective
General Objective	Median values should not fall below 85 percent saturation as a result of controllable water quality conditions.
General Objective	Minimum of 5 mg/L

3. DATA REVIEW

This section summarizes the data collected by the Regional Board and volunteers as part of the Morro Bay National Monitoring Program (NMP) and the Volunteer Monitoring Program (VMP). Data include dissolved oxygen, nitrate concentrations, temperature, and anecdotal information on algal growth in Chumash Creek. Figure 1 shows the only monitoring location (CHU) on Chumash Creek.

3.1. Dissolved Oxygen

Chumash Creek was included in the Morro Bay National Monitoring Program (NMP), a ten-year Best Management Practice (BMP) implementation and monitoring project (RWQCB, 2002). According to the NMP, improvements in dissolved oxygen were detected at CHU following BMP implementation, as levels became less variable following BMP implementation.

Figure 2 shows available dissolved oxygen concentrations and Table 3 summarizes percent saturation data. Only three (3) samples of a total of 245 samples taken between 1993 and 2003 fell below the dissolved oxygen general numeric objective of 5 mg/l, indicating that this water quality objective (WQO) is being met in Chumash Creek. In an analysis of percent saturation data collected from Chumash Creek, median values fell below the WQO from 1997 to 2003 (see Table 3).

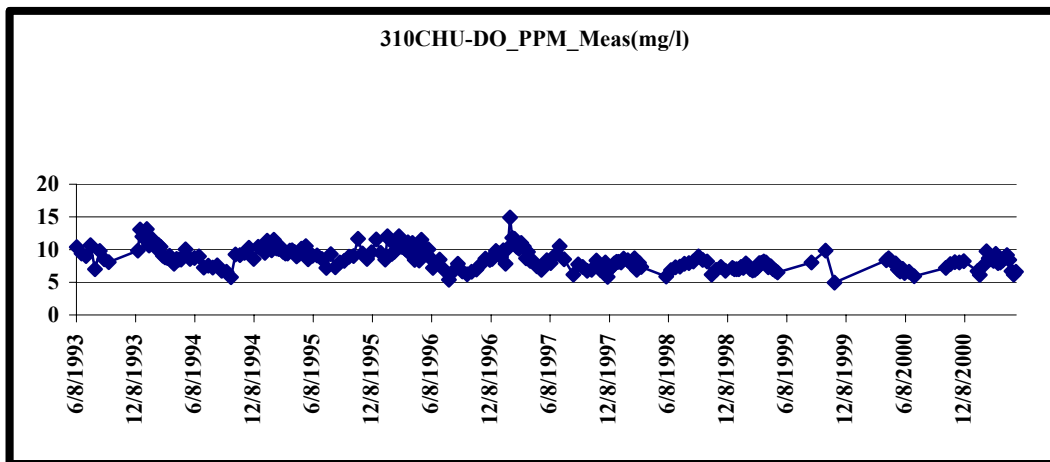


Figure 2. Dissolved oxygen levels in Chumash Creek

As shown in Table 3, annual maximum values of percent saturation have also declined since 1997, indicating that the presence of super-saturated conditions has decreased. This is consistent with the NMP project finding that dissolved oxygen levels have improved as a result of BMP implementation (RWQCB, 2002).

Table 3. Summary of Dissolved Oxygen Data in Chumash Creek (percent saturation)

Year	CHU		
	No. of Samples	Maximum	Median
1993	11	128.7	108.0
1994	76	122.0	93.4
1995	36	122.2	98.8
1996	39	127.3	95.7
1997	36	134.1	84.6
1998	25	95.8	80.2
1999	22	97.3	71.9
2000	15	90.4	74.5
2001	17	90.1	78.8
2002	n/a	n/a	n/a
2003	6	93.1	77.7

3.2. Nutrients

Nitrate levels do not exceed the water quality objective for the municipal and domestic water supply (MUN) use of 10 mg/L. According to the National Monitoring Program (RWQCB, 2002), no significant reductions of either nitrates or phosphates were observed as a result of BMP implementation. In fact, nitrates increased following BMP implementation, possibly due to the development of instream vegetation. The relationship between nutrient and dissolved oxygen levels in Chumash Creek is indeterminate.

3.3. Algal Growth

Algal growth has been observed in Chumash Creek; however, documentation between 1993 and 2003 is very limited. Algal data are primarily anecdotal and do not provide consistent documentation on severity and extent of coverage and effect on use, making it difficult to clearly identify the impact of algal growth on uses in Chumash Creek. Information documents the presence of algal growth, but does not demonstrate any correlation to depressed oxygen levels.

3.4. Water Temperature

Significant decreases in water temperature have been observed as a result of BMP implementation, however the relationship to dissolved oxygen levels is indeterminate.

3.5. Data Summary

The dissolved oxygen general numeric WQO of 5.0 mg/l is being met in Chumash Creek. Dissolved oxygen levels do not meet the general WQO that median values should not fall below 85 percent saturation. Data analyses are inconclusive in establishing a relationship between nutrients, algal growth, temperature, and dissolved oxygen.

BMPs implemented along Chumash Creek are resulting in improvements to dissolved oxygen, however; dissolved oxygen levels do not yet meet WQOs. Because data indicate an impairment by dissolved oxygen, a TMDL will be developed for dissolved oxygen in Chumash Creek.

4. SOURCE ANALYSIS

This section identifies potential sources of the dissolved oxygen impairment in Chumash Creek.

The land use within the Chumash Creek watershed is rangeland, managed by Cal Poly. Rangeland Best Management Practices installed in the Chumash Creek watershed have resulted in significant improvements in dissolved oxygen. As a result, staff determines that the source of impairment is being corrected, and anticipates that ultimately the WQOs in Chumash Creek will be met.

5. DISSOLVED OXYGEN TMDL

The TMDL represents the loading capacity of a waterbody—the amount of a pollutant that the waterbody can assimilate and still support beneficial uses. The TMDL is the sum of allocations for nonpoint and point sources and any allocations for a margin of safety. TMDLs are often expressed as a mass load of the pollutant but can also be expressed as a unit of concentration (40 CFR 130.2(i)).

The dissolved oxygen TMDL for Chumash Creek is set at a minimum concentration for dissolved oxygen of 5.0 mg/l and a median value equal to or greater than 85 percent saturation. Monthly concentrations may not fall below 5 mg/l and annual median values may not fall below 85 percent saturation. The allocations, which include background levels, are also equal to the numeric targets. Cal Poly is given a load allocation equal to the numeric targets. Nonpoint source discharges cannot cause receiving water in Chumash Creek to exceed the numeric target values.

Staff has not identified any point source discharges to Chumash Creek that contribute to the impairment so no wasteload allocation is necessary. The WDRs include water quality requirements to cover the entire spectrum of campus activities in Chumash Creek and adjacent watersheds, and are intended to assure compliance with the Basin Plan and applicable laws and regulations pertaining to nonpoint source discharges campus-wide.

Expressing the TMDL as a dissolved oxygen concentration in receiving water equal to the WQOs (a minimum concentration for dissolved oxygen of 5.0 mg/l and a median value equal to or greater than 85 percent saturation) provides a direct measure of the dissolved oxygen levels in the watershed to compare with water quality objectives and provides a measurable target for sources to monitor and with which to comply. Requiring the responsible parties to maintain dissolved oxygen levels at the numeric target of 5 mg/l and median percent saturation values at or above the numeric target of 85% establishes a direct link between the TMDL target and sources.

Seasonality is not a determining factor in the TMDL because the TMDL is equal to the dissolved oxygen WQO, which must be met at all times. In addition, while dissolved oxygen levels are typically less in the summer and fall months, existing data indicate that WQO violations occur during both wet and dry seasons.

The margin of safety for this TMDL is implicitly included through the use of the dissolved oxygen WQOs as the TMDL. The WQOs were established using conservative assumptions, translating to an implicit margin of safety.

6. MONITORING

This section discusses the planned monitoring in the Chumash Creek watershed. Monitoring will include continued water quality monitoring to measure the progress of the creek in meeting the dissolved oxygen TMDL targets.

Monitoring will be performed by the Morro Bay Volunteer Monitoring Program (VMP) in Chumash Creek to ensure that the numeric target is met. Volunteer monitors will measure dissolved oxygen concentrations at CHU on a monthly basis. Cal Poly will coordinate with the VMP to allow access for continued monitoring. If VMP monitoring efforts cease, the Executive Officer will require Cal Poly to monitor pursuant to California Water Code Section 13267. Regional Board staff will pursue collecting additional dissolved oxygen data at pre-dawn hours to obtain information relative to diurnal fluctuations.

7. IMPLEMENTATION

Cal Poly, the sole owner and manager of the rangeland in Chumash Creek, implemented a suite of BMPs (i.e. riparian corridor revegetation) between 1995 and 1996 designed to improve water quality; dissolved oxygen levels are improving as a result. Staff is confident that existing BMPs will implement the Chumash Creek Dissolved Oxygen TMDL and ultimately result in attainment of the associated water quality objectives.

Cal Poly is subject to waste discharge requirements (WDRs) (Order No. R3-2003-0035). The WDRs include water quality requirements to cover the entire spectrum of campus activities, and are intended to assure compliance with the Basin Plan and applicable laws and regulations pertaining to nonpoint source discharges campus-wide. The WDRs require Cal Poly to implement a Water Quality Management Plan (WQMP).

The Clean Water Act does not require TMDLs to be adopted as Basin Plan amendment. Where a single permit action will address an impairment, the permit can serve as the TMDL as long as the permit includes all TMDL requirements. Staff proposes that the impairment be addressed and the TMDL be implemented via modifications to Cal Poly's WDRs and WQMP. While Cal Poly is updating the WQMP this year, permit renewal is not scheduled until 2008. Actions to be incorporated as WDR/WQMP requirements will result in ultimate achievement of the TMDL. WQMP requirements are enforceable through Cal Poly's WDRs.

The WDRs require Cal Poly to update the WQMP as necessary, subject to approval by the Regional Board or the Executive Officer. Included in the plan are rangeland BMPs. Cal Poly is currently undergoing an internal WQMP update and has agreed to include the required elements for Chumash Creek in this update. Required TMDL elements include a load allocation, margin of safety, implementation plan, and tracking and reporting mechanisms. The WQMP along with the renewed permit will include all of the required TMDL elements, as follows:

TMDL and load allocation: The dissolved oxygen TMDL for Chumash Creek is set at a minimum concentration for dissolved oxygen of 5.0 mg/l and a median value equal to or at least 85 percent saturation. Monthly concentrations may not fall below 5 mg/l and annual median values may not fall below 85 percent saturation. The allocations, which include background levels, are also equal to the numeric targets. Cal Poly is given a load allocation equal to the numeric targets. Nonpoint source discharges cannot cause receiving water in Chumash Creek to exceed the numeric target values.

MOS: The margin of safety for this TMDL is implicitly included through the use of the dissolved oxygen WQO as the TMDL. The WQO was established using conservative assumptions, translating to an implicit margin of safety.

Implementation: Cal Poly will continue to implement Best Management Practices (BMPs) on Chumash Creek designed to improve dissolved oxygen concentrations (i.e. riparian corridor revegetation).

Tracking and reporting: Cal Poly will submit an annual report indicating current BMPs implemented at Chumash Creek (i.e. miles of creek revegetated) to improve dissolved oxygen concentrations to levels consistent with water quality objectives, and any proposed changes to BMPs that may adversely impact dissolved oxygen levels.

Cal Poly will coordinate with the Morro Bay Volunteer Monitoring Program (VMP) to allow access and obtain data in order to report number of exceedances of water quality objectives and ultimate achievement of the TMDL.

7.1. Measuring Progress

Cal Poly submits quarterly and semi-annual reports as part of existing reporting requirements included in the WQMP. As part of reporting, Cal Poly will describe current BMP implementation at Chumash Creek that is intended to improve dissolved oxygen levels, and any

proposed changes to BMP implementation that may adversely impact dissolved oxygen levels. Additionally, Cal Poly will coordinate with the VMP to allow access and obtain data in order to report attainment or exceedances of water quality objectives and ultimate achievement of the TMDL.

Regional Board staff will conduct a review to evaluate implementation efforts every three years in conjunction with the *Morro Bay Sediment and Pathogen TMDL* evaluations. Regional Board staff will utilize information submitted by Cal Poly and the VMP to evaluate BMP implementation efforts and dissolved oxygen conditions. Regional Board staff will evaluate number of exceedances of water quality objectives, if any, and ultimate achievement of the TMDL.

Regional Board staff may conclude and articulate in the review that ongoing implementation efforts may be insufficient to ultimately achieve the allocations and numeric target. If this occurs, Regional Board staff will recommend revisions to the implementation plan. Regional Board staff may conclude and articulate in the three-year review that to date, implementation efforts and results are likely to result in achieving the allocations and numeric target, in which case existing and anticipated implementation efforts should continue.

7.2. Timeframe

Regional Board staff will confirm that tracking and reporting mechanisms are in place in one year, and evaluate progress towards achieving the water quality objective every three years. Staff will review reports submitted by Cal Poly, along with monitoring information collected by the VMP relative to the numeric target.

The implementation period to meet the allocation and verify TMDL achievement is 6 years. This schedule is reasonable because BMPs are in place and, while water quality objectives are not yet being met, improvements as a result of BMP implementation are already occurring. Staff is confident that as riparian vegetation becomes further established, dissolved oxygen levels will continue to improve, and the water quality objectives will be attained.

If the allocated loads are not met within this timeframe, staff will re-evaluate the implementation plans and schedule, and if necessary recommend a more stringent approach to the board. If allocations and numeric targets are being met, Regional Board staff will recommend the waterbody be removed from the 303(d) list.